

1. **DESCRIPTION:** Students will demonstrate an understanding of the basic concepts of mathematics and physics relating to stellar evolution and **Type II Supernovas**.

A TEAM OF UP TO: 2 **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:** Each **team** may bring either two laptop computers or two 3-ring binders (any size) containing information in any form from any source, or one binder and one laptop. The materials must be 3-hole punched and inserted into the rings (notebook sleeves are allowable). Each team member is permitted to bring a programmable calculator. No Internet access is allowed.
3. **THE COMPETITION:** Using information which may include Hertzsprung-Russell diagrams, spectra, light curves, motions, cosmological distance equations and relationships, stellar magnitudes and classification, multi-wavelength images (X-ray, UV, optical, IR, radio), charts, graphs, animations and DS9 imaging analysis software, participants will complete activities and answer questions related to:
 - a. Stellar evolution, including spectral features and chemical composition, luminosity, blackbody radiation, color index (B-V), and H-R diagram transitions, stellar nurseries and star formation, proto-stars, main sequence stars, **Cepheid variables, semiregular variables, red supergiants, neutron stars, magnetars, pulsars, Wolf-Rayet stars, stellar mass black holes, x-ray binary systems, and Type II supernovas.**
 - b. Use Kepler's laws, rotation and circular motion to determine answers relating to the orbital motions of binary and multiple star systems; use parallax, spectroscopic parallax, and the distance modulus to calculate distances to **Type I and Type II Cepheids.**
 - c. Identify, know the location and answer questions relating to the content areas outlined above for the following Objects: **Cas A, IGR J17091, NGC 6888/WR 136, PSR J0108-1431, Cygnus X-1, SXP 1062, M1, V838 Mon, Delta Cep, α Orionis, SN 2010JL, NGC 3582, LHa115-N19, Antares/Rho Ophiuchi cloud complex and IC 1396.**
4. **SCORING:** All questions will have been assigned a predetermined number of points. The highest score wins. Selected questions having differentiated weights will be used to break ties.

Recommended Resources: All reference and training resources including the **Astronomy CD** are available on the Official Science Olympiad Store or on the Website at <http://www.soinc.org> Also: <http://www.aavso.org/> ; <http://chandra.harvard.edu/photo/index.html> <http://antwrp.gsfc.nasa.gov/apod/astropix.html>

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